UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

Refer to:
2002/01273

December 18, 2002

Julia Dougan
Eugene District Manager
U.S. Bureau of Land Management
P.O. Box 10226
Eugene, OR 97440

Re: Endangered Species Act Formal Section 7 Consultation and Magnuson-Stevens Act Essential Fish Habitat Consultation, Travis Tyrrell Seed Orchard - Year 2003 Esfenvalerate Application, Bureau of Land Management, Eugene District, Lane County, Oregon.

Dear Ms. Dougan:

Enclosed is a biological opinion (Opinion) prepared by the National Marine Fisheries Service (NOAA Fisheries) pursuant to section 7 of the Endangered Species Act (ESA) for the application of the insecticide esfenvalerate during 2003 at Travis Tyrrell Seed Orchard, Lane County, Oregon. NOAA Fisheries concludes in this Opinion that the proposed action is not likely to jeopardize Oregon Coast coho salmon (*Oncorhynchus kisutch*). Pursuant to section 7 of the ESA, NOAA Fisheries has included reasonable and prudent measures with non-discretionary terms and conditions that are necessary and appropriate to minimize the potential for incidental take associated with this project.

This Opinion also serves as consultation on essential fish habitat pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act and its implementing regulations (50 CFR Part 600).

Please direct questions regarding this letter to Rob Markle of my staff in the Oregon Habitat Branch at 503.230.5419.

Sincerely,

For Michael R Crouse

D. Robert Lohn
Regional Administrator

Endangered Species Act Section 7 Consultation
Biological Opinion
and
Magnuson-Stevens Act
Essential Fish Habitat Consultation

Travis Tyrrell Seed Orchard - 2003 Application of Esfenvalerate Insecticide
Siuslaw River Basin, Lane County, Oregon

Agency: Bureau of Land Management, Eugene District

Consultation
Conduced By: National Marine Fisheries Service,
Northwest Region

Date Issued: December 18, 2002

Issed by: For Michael R Crouse
D. Robert Lohn
Regional Administrator

Refer to: **2002/01273**

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Parts per million
1 ppm = 1,000 ppb (parts per billion)
1 ppm = 1,000 mu g/L (micrograms per liter)
1 ppm = 1 mg/L (milligrams per liter)

Parts per billion
1 ppb = 0.001 ppm (parts per million)
1 ppb = 0.001 mg/L (milligrams per liter)
1 ppb = 1 mu g/L (micrograms per liter)

1. ENDANGERED SPECIES ACT

1.1 Background

The Bureau of Land Management (BLM) requested formal consultation under section 7 of the Endangered Species Act (ESA) with the National Marine Fisheries Service (NOAA Fisheries) for Oregon Coast (OC) coho salmon (*Oncorhynchus kisutch*) on a proposed application of the insecticide esfenvalerate in 2003 at the Travis Tyrrell Seed Orchard (Tyrrell Orchard) near Lorane, Oregon, in a letter received on October 29, 2002. The letter was accompanied by a biological assessment (BA) for the proposed action.

The BLM proposes to apply esfenvalerate at the Tyrrell Orchard to control Douglas-fir gallmidge (*Contarinia oregonensis*) and Douglas-fir seed chalcid (*Megastigmas spermotrophus*). Esfenvalerate, in the form of Asana® XL (Asana), would be applied to cone-bearing trees in two units totaling 29 acres. The purpose of the action is to control cone insects that cause damage and seed loss to orchard cone crops. The 832.5-acre orchard is located three miles west of Lorane, Oregon.

The subject action would occur in an unnamed drainage of the Siuslaw River identified as Stream 8. Stream 8, a perennial tributary, flows into the Siuslaw River at approximately river-mile 107. The Stream 8 drainage is flanked to the west by Douglas Creek, and to the east by a perennial Siuslaw River tributary identified as Stream 1. Douglas Creek flows into the Siuslaw River at approximately river mile 106.5, and Stream 1 enters the Siuslaw River at river mile 108.

The Oregon Coast Province Fisheries Level 1 Consultation Streamlining Team (Team) reviewed and provided input to the BLM during the development of the BA. During a previous consultation, NOAA Fisheries staff visited the Tyrrell Orchard on February 14, 2001.

Manual treatments to reduce insect damage have been attempted for the past three years. In spite of this effort, seed extraction completed in 1999, 2000, and 2001 showed a considerable reduction in yield due to insect problems. Preliminary reports indicate the estimated loss from insect-related damage was approximately 34% in 2000 and 25% in 2001. Non-chemical methods of insect control were considered, including pheromone gallmidge traps and the use of high volume vacuums. However, these methods remain experimental at this time. If insecticide is not used, estimates for 2003 suggest 40% of the seed crop may be lost to insect damage.

This Opinion considers the potential effects of the proposed action on OC coho salmon, which occur in the proposed project area. OC coho salmon were listed as threatened under the ESA on August 10, 1998 (63 FR 42587) and protective regulations were issued on July 10, 2000 (65 FR 42422). Critical habitat is currently not designated or proposed for the OC coho salmon evolutionarily significant unit (ESU). The objective of this Opinion is to determine whether the proposed action is likely to jeopardize the continued existence of OC coho salmon. This consultation is conducted pursuant to section 7(a)(2) of the ESA and its implementing regulations, 50 CFR 402.

1.2 Proposed Action

In spring 2003, BLM proposes to apply the insecticide Asana (active ingredient is esfenvalerate) in two units (Swisshome/Mapleton and Noti) totaling 29 acres. Water is the carrier agent, and no surfactants or other additives will be used (G. Miller, BLM, personal communication via telephone, March 30, 2001). Asana must be applied in mid- to late April for maximum effectiveness. Application will occur by one of two methods, aerial or ground-based. The BLM will make the decision on which method to use at a later date, and consultation was requested on both application methods. One application of Asana is proposed with specific timing dependent on the target insect and its time of emergence. Most of the trees planned for treatment are under 40 feet in height. Aerial application will treat all trees within the units (~2,333 trees), while ground-based application will only treat cone-bearing trees (~1,633 trees). Traps would be set to determine the timing of emergence and level of infestation of the Douglas-fir cone gallmidge and the Douglas-fir seed chalcid.

A detailed description of the proposed action can be found on pages 4 through 14 of the BA submitted by the BLM (BLM 2002a).

1.2.1 Proposed Conservation Measures

The BLM has proposed the following conservation measures in the BA to minimize the threat of waterway contamination and downstream affects on OC coho salmon.

1. Applicable to either application method:
    a. Precautions will be taken to assure that equipment used for transport, mixing, and application will not leak pesticides into water or soil.
    b. Areas used for mixing insecticide would be located at least 200 feet from streams with water.
    c. A spill kit, filled with absorbent materials, will be located near the mixing area in the event of an accidental spill.
    d. A minimum buffer width between the treatment areas and perennial streams will be 200 feet.
    e. Spraying will not occur over water bodies (ponds, streams, live water). [Author's note: this measure was included in the compliance monitoring section of Appendix B: Water Quality Monitoring Plan (attached in this Opinion as Appendix A).]

    f. Applications will be timed so as not to coincide with or closely precede large storm events that could result in substantial runoff. If rain precedes the intended application window, orchards will be checked for infiltration rate prior to application.

g. Application will not occur if soils are saturated. Saturation levels will be determined by a soil scientist.
h. Application unit boundaries will be clearly marked with highly visible traffic cones or flagging in a manner that would allow visual identification from the air or ground.
i. Smoke flares will be deployed in each orchard prior to application to provide for pilot/applicator recognition of wind speed and direction.
j. Water quality monitoring will occur before and after application. Monitoring would consist of compliance, effectiveness, and validation monitoring, and include sampling edge of field runoff and Stream 8 flows. Refer to Appendix A for monitoring plan specifics.
k. Spray detection cards will be placed 35, 50 and 100 feet from the edge of the treatment units along riparian buffers. They would be spaced 100 to 200 feet apart. Additionally, a few cards would be strategically placed next to Stream 8 (both sides). Following application, the drift cards will be reviewed to determine if drift has occurred, the extent of the drift, and the potential for contamination of the adjacent waterbodies.
l. Silt fence catchment barriers will be installed in swales located adjacent to or inside treatment units. The function of these barriers would be to catch organics, sediment, and adsorbed insecticide leaving the treatment area.
m. Soil aeration will be done along unit boundaries downslope from treatment units and above catchment barriers. This will decrease compaction, increase porosity and infiltration, reduce overland flow, and maximize binding of insecticide by soils.
n. All applicable local, state and Federal laws, including the pesticide labeling instruction of the Environmental Protection Agency, will be strictly followed.
o. Pesticides will be applied within the prescribed environmental conditions stated on the label. This will include consideration of relative humidity, wind speed, and air temperature when determining the timing of application relative to drift reduction.
p. Pesticide applicator licensing and training will be used as a quality control measure.

2. Applicable to ground-based application:
   a. Nozzles will be directed away from the fence lines and riparian areas to reduce drift.

3. Applicable to aerial application:
   a. Flight patterns will occur parallel to streams and buffer areas when operationally feasible.
   b. Flight patterns will not cross water bodies (ponds, steams, live water).
   c. Spray will be released at the lowest height consistent with pest control and flight safety.
   d. Areas immediately adjacent to buffers will be treated prior to the rest of a unit.

e. The helicopter will operate around the buffer areas with the boom closest to the sensitive area turned off to provide maximum spray control.

1.2.2 Summary

A summary of the proposed action is found below (Table 1). The table provides a comparison of the aerial and ground-based methods proposed by the BLM.

Table 1. Comparison of Treatment Alternatives for Application of Esfenvalerate.

Operational Concerns	Aerial Application	Ground Application
Proposed Application Equipment	Turbine-powered Hiller UH-12E Helicopter	Truck or tractor-fitted hydraulic sprayer with hand-held trigger nozzles on hoses.
Proposed Insecticide	Asana® XL	Asana® XL
Proposed Application Rates (Avg.)	0.190 lb/ac.	0.056 lb/ac
Application Period	April to early May	April to early May
Number of Trees that would be Sprayed	Approximately 2494 Trees (all live trees would be treated)	Approximately 1633 Trees (only cone bearing trees would be treated)
Duration of Spray Activities	1 hour of one day	27 hours over a one to two week period, depending on weather conditions
Number of Times Formulation Must be Mixed/Handled to Complete Project	4 times (twice for each orchard using 100 gal. tank and application rate of 10 gal. of mixture/acre).	33 times (with 200 gal. tank and application rate of 4 gal. of mixture/acre).
Weather Limitations for Spray Activities	Wind $\leq$ 6 mph, RH > 50%, no fog, no precipitation or inversions present or imminent, no snow or ice on foliage, no wind turbulence.	Wind $\leq$ 6 mph, RH > 50%, no fog, no precipitation or inversions present or imminent, no snow or ice on foliage, no wind turbulence.
Droplet Size	200-300 microns with D8 orifice straight stream nozzle, flying at 50 mph and spray pressure of 28 psi.	200-300 microns with orifice and pressure determined by tree heights and weather conditions.
Drift Control Measures	• Application height would be $\leq$ ½ the width of the rotor, which pushes the spray into the canopy by downward air pressure. • Orchard boundaries would be flown with no-spray areas to the right of the helicopter. The right-half of the boom would be turned off, forcing the spray behind and to the left of the ship, away from riparian buffers. • Pilot would turn off nozzles prior to pulling up at end of each flight line. Nozzles would not be turned on again for the next pass until the boom is horizontal with the tree tops.	• When spraying along orchard boundaries, nozzles would be directed toward the middle of the orchard.
Drift Deposition (25 ft. from Spray Boundary)	0.00090 lb/ac. (per Risk Assessment)	0.00230 lb/ac. (per Risk Assessment)
Drift Cards Placement	Placed 35, 50 and 100 ft. outside treatment units along riparian buffers, with 100 - 200 ft spacing between cards. Cards would also be strategically placed along Stream 8.	Placed 35, 50 and 100 ft. outside treatment units along riparian buffers, with 100 - 200 ft spacing between cards. Cards would also be strategically placed along Stream 8.

Operational Concerns	Aerial Application	Ground Application
Drift Card Monitoring	Following application, cards would be reviewed to determine drift occurrence, extent of drift, and potential for contamination. Due to the short period of time to complete the aerial operation, the cards could not be used to modify spray operations.	Following application, cards would be reviewed to determine drift occurrence, extent of drift, and potential for contamination. Because this application method is relatively slow and spread out over a longer time frame, it would be possible to monitor drift cards concurrently with spray operations, allowing for tactical modifications to be made if necessary.
Water Monitoring	See Appendix A (or BA: pages 48-54)	See Appendix A (or BA: pages 48-54)

1.3 Biological Information

Although there are currently limited data to assess population numbers or trends, all coho salmon stocks comprising the OC coho salmon ESU are depressed relative to past abundance. The status and relevant biological information concerning OC coho salmon are well described in the proposed and final rules from the Federal Register (60 FR 38011, July 25, 1995; and 63 FR 42587, August 10, 1998, respectively), and Weitkamp *et al.* (1995).

Abundance of wild coho salmon spawners in Oregon coastal streams declined during the period from about 1965 to roughly 1975, and has fluctuated at a low level since that time (Nickelson *et al*. 1992). Despite better-observed spawning escapements in 2001, population trends remain low (Table 2). Contemporary production of coho salmon may be less than 10% of the historic production (Nickelson *et al*. 1992). Average spawner abundance has been relatively constant since the late 1970s, but preharvest abundance has declined. Average recruits-per-spawner may also be declining. The OC coho salmon ESU, although not at immediate danger of extinction, may become endangered in the future if present trends continue (Weitkamp *et al*. 1995).

The bulk of production for the OC coho salmon ESU is skewed to its southern portion, where the coastal lake systems (*e.g.*, Tenmile, Tahkenitch, and Siltcoos basins) and the Coos and Coquille Rivers are more productive. Siuslaw River coho salmon populations have been characterized as depressed (*e.g.*, spawning habitat underseeded, declining trends, or recent escapements below long-term average) and at moderate risk of extinction (Weitkamp *et al.* 1995).

The Siuslaw River basin has approximately 514 miles of coho salmon spawning habitat (Hollen *et al.* 1998). Coho salmon abundance in the Siuslaw River is approximately 2% of historic levels. A recent estimate of average annual wild coho salmon spawner abundance is 4,441 spawners (n=12) with a range of 668 spawners (1997) to 11,024 spawners (2001) (ODFW 2001, ODFW 2002) (Table 2). Historic coho salmon runs were estimated to be approximately 209,000 adults (circa 1890) (EcoTrust 2002). Estimates of historic coho salmon production indicate that the Siuslaw River basin (562 coho/mi^2) was twice as productive as the nearby Yaquina (204 coho/mi^2) and Alsea (261 coho/mi^2) River basins (EcoTrust 2002).

Table 2. Estimated Spawning Populations for Naturally-Produced Coho Salmon in the Siuslaw River Basin (population information source: ODFW 2001, 2002).

	Estimated Wild Coho Population		
	Siuslaw River Basin		*OC ESU*
Year	**Number of fish**	**Calc. % of ESU**	**Number of fish**
1990	2,685	16	16,510
1991	3,740	13	29,078
1992	3,440	9	38,604
1993	4,428	10	44,266
1994	3,205	9	37,477
1995	6,089	15	41,303
1996	7,625	13	59,453
1997	668	5	14,068
1998	1,089	5	19,816
1999	2,724	8	34,646
2000*	6,571	12	52,678
2001*	11,024	7	149,058
Average	4,441	10	44,746

* Figures are preliminary.

A watershed assessment (EcoTrust 2002) describes coho salmon use in the Siuslaw basin:

> ... coho salmon numbers are severely depressed. Coho are found in all but the smallest headwater tributaries within the basin. They are also absent from the mainstem Siuslaw river and mainstems of major tributaries during the hot summer months. While our whole basin juvenile distribution for coho is scanty, available recent records from agencies and the one year of snorkel counts suggest that some areas are more important than other areas for the current production of coho salmon in the basin...
>
> Coho salmon and steelhead trout are the two most depressed salmonids in the Siuslaw basin. Both these species reside spatially in similar sized streams (however they differ in their preferred habitat). They both typically live for over a year in freshwater. The majority of Chinook salmon reside in freshwater for only a few months in the spring, then head to the estuary. This suggests that the existing freshwater habitat (below the headwater reaches inhabited by cutthroat) is likely not in good condition for summer and winter rearing. This thesis is

> corroborated by the fact that habitat surveys for these reaches note mostly poor quality.
>
> It may also be more than coincidence that coho salmon and steelhead trout are the two salmonids that are most depressed, and they have had a history of the most significant hatchery programs within the basin. The two species that are considered to be in the best shape, Chinook salmon and resident cutthroat, are the two that have not had any significant hatchery program in the basin.

Timing of adult coho salmon river entry is largely influenced by river flow. Coho salmon normally wait for freshets before entering rivers. In the Siuslaw River watershed, adults are believed to typically enter the river between September and mid-January (Tami Wagner, ODFW, personal communication via telephone with R. Markle, February 6, 2001), with peak migration into the Siuslaw River occurring in October (Mullen 1981, as cited in Weitkamp *et al*. 1995) (Table 3). Spawning occurs from late October to late January, with peak spawning generally occurring in mid-December (Weitkamp *et al*. 1995). Intragravel residency (egg to fry) varies greatly between basins and reaches, and is largely dependent on substrate composition and water temperature (Groot and Margolis 1991). No specific information is available on intragravel residence timing in the Siuslaw River watershed. However, a study done in Oregon coastal streams found an average incubation period of 110 days, with emergence typically occurring two to three weeks following hatch (Groot and Margolis 1991). This suggests a four- to five-month intragravel residency period. Seaward migration of juveniles occurs during the spring. Reports of outmigration timing vary from February through June (Rodgers *et al*. 1993, as cited in Weitkamp *et al*. 1995) to March into early July (Tami Wagner, ODFW, personal communication via telephone with R. Markle, February 6, 2001).

Table 3. OC Coho Salmon Life History Timing.

	Calendar Year (month)											
Life History Event	J	F	M	A	M	J	J	A	S	O	N	D
River Entry												
Spawning												
Intragravel Development												
Juvenile Rearing												
Juvenile Out-migration												

In the project area, coho salmon are found in Douglas Creek and in the unnamed tributary referred to as Stream 8. The proposed spray area is not hydrologically connected to Douglas Creek, which is west of the spray area and separated from it by a low ridge. Stream 8 flows between the two proposed treatment units. Coho salmon in Stream 8 are found approximately 500 feet below the proposed spray unit at the Road 20-5-16 culvert (barrier). The BLM has indicated that historically, coho salmon presence likely extended upstream of the culvert for approximately 700 feet to a waterfall that is a natural barrier to any upstream movement of fish.

The unnamed tributary referred to as Stream 1 is located east of the spray area, and is not hydrologically connected to the treatment units. However, at its closest point, a Stream 1 tributary (Stream 55) is located only 200 feet northeast of the Noti unit spray boundary. Seining of Stream 1 found no coho salmon. The Siuslaw River Road culvert is an artificial barrier to upstream fish migration. Based on maps provided by the BLM, the point where Stream 55 is closest to the spray area is located approximately 0.5 miles upstream of the road. In Stream 1 below the Siuslaw River Road, sculpin were the only fish found, although the BLM states that habitat appears suitable for coho salmon use.

Though their presence is unconfirmed, chinook salmon (*Oncorhynchus tshawytscha*) have been reported in the Siuslaw River near the mouth of Douglas Creek.

1.4 Evaluating Proposed Actions

The standards for determining jeopardy are set forth in section 7(a)(2) of the ESA (50 CFR 402). NOAA Fisheries must determine whether the action is likely to jeopardize the listed species. This analysis involves the initial steps of defining the biological requirements and current status of the listed species, and evaluating the relevance of the environmental baseline to the species' current status.

Subsequently, NOAA Fisheries evaluates whether the action is likely to jeopardize the listed species by determining if the species can be expected to survive with an adequate potential for recovery. In making this determination, NOAA Fisheries must consider the estimated level of mortality attributable to: (1) Collective effects of the proposed or continuing action; (2) the environmental baseline; and (3) any cumulative effects. This evaluation must take into account measures for survival and recovery specific to the listed salmonid's life stages that occur beyond the action area. If NOAA Fisheries finds that the action is likely to jeopardize the listed species, NOAA Fisheries must identify reasonable and prudent alternatives for the action.

For the proposed action, NOAA Fisheries' jeopardy analysis considers direct and indirect mortality of fish attributable to the action. NOAA Fisheries considers the extent to which the proposed action impairs the function of essential elements necessary for juvenile and adult migration, spawning, and rearing of OC coho salmon under the existing environmental baseline.

1.4.1 Biological Requirements

The first step in the methods NOAA Fisheries uses for applying the ESA to listed salmon is to define the biological requirements of the species most relevant to each consultation. NOAA Fisheries also considers the current status of the listed species, taking into account population size, trends, distribution and genetic diversity. To assess the current status of the listed species, NOAA Fisheries starts with the determinations made in its decision to list OC coho salmon for ESA protection and also considers new data available that are relevant to the determination.

The relevant biological requirements are those necessary for OC coho salmon to survive and recover to naturally-reproducing population levels, at which time protection under the ESA would become unnecessary. Adequate population levels must safeguard the genetic diversity of the listed stock, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment.

For this consultation, the biological requirements are improved habitat characteristics that function to support successful spawning, rearing, and migration. The current status of OC coho salmon, based upon their risk of extinction, has not significantly improved since the species was listed and, in some cases, their status may have worsened.

1.4.2 Environmental Baseline

The environmental baseline is an analysis of the effects of past and on-going human and natural factors leading to the current status of the species or its habitat and ecosystem within the action area. The action area is defined as all areas (bankline, adjacent riparian zone, and aquatic area) to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). Direct effects occur at the project site and may extend upstream or downstream based on the potential for impairing fish passage, hydraulics, sediment and pollutant discharge, and the extent of riparian habitat modifications. Indirect effects may occur throughout the watershed where the actions described in this Opinion lead to additional activities or affect ecological functions contributing to stream degradation. For this consultation, the action area includes the treatment units (Swisshome/Mapleton and Noti) and those reaches of streams potentially effected by runoff and/or spray drift deposition (*i.e.*, all reaches and tributaries of Stream 8 between Stream 7 [exclusive] and the Siuslaw River, all reaches and tributaries of Douglas Creek between Stream 11 [exclusive] and the Siuslaw River, and all reaches and tributaries of Stream 1 between Stream 56 [exclusive] and the Siuslaw River).

Within the action area, the coho salmon population is depressed and habitat is underseeded. Coho salmon typically spawn in the streams associated with the Tyrrell Orchard in December, and fry would be expected to emerge prior to or about the time of the proposed insecticide application, depending on water temperatures.

The Tyrrell Orchard was established in 1983 as a centralized tree seed orchard designed to provide genetically-improved Douglas-fir seed for BLM's Coos Bay, Roseburg and Eugene Districts. The orchard has 24 Douglas-fir seed production units. These units range in age from six to thirteen years and have measurable cone production beginning at about age nine. Since the oldest orchard units have just started to produce cone crops in the past several years, the demand for seed from the Tyrrell Orchard is very high. The ground within the orchard is thoroughly covered with vigorous grasses.

The Douglas Creek watershed is 2,965 acres and the Stream 8 watershed is approximately 450 acres. The BA did not include an estimate of watershed size for Stream 1. Forestry is the predominate land use within the Upper Siuslaw River watershed. Winters typically are mild and wet, while summers are cool and relatively dry.

The Siuslaw River is on the Oregon Department of Environmental Quality (ODEQ) 303(d) List of Water Quality Limited Water Bodies for temperature (ODEQ 2002). The temperature standard (64 ^{0}F) is regularly exceeded (63%) during summer flows from the mouth to the headwaters. Historic readings at Mapleton indicate temperature exceedences occurred in 1980, 1982, and 1984 to 1992 with a maximum of 75.2 ^{0}F.

In the BA, the BLM provided a table summarizing annual precipitation in the area based on Cottage Grove values and runoff patterns for the Siuslaw River near Mapleton (Table 4). This information indicates that the high-precipitation period occurs from November through March, with approximately 69% of the annual precipitation occurring during those five months. For that same five-month period, approximately 81% of the annual runoff takes place. April/May is a transition period with approximately 13% of the annual total precipitation and 12% of the annual runoff. The mean monthly precipitation amounts for April and May are 3.5 and 2.5 inches, respectively.

1.5 Analysis of Effects

1.5.1 General Effects of Insecticides on Aquatic Life

The effects of chemical insecticide use frequently extend beyond the intended target species. Insecticide composition (including inert ingredients, carrier agents, and surfactants), chemical character, environmental conditions (including weather), and application techniques are among the variables that determine insecticide effects on non-target species and their ecosystems. Inert ingredient toxicity is frequently overlooked and is often little studied or understood. Scientific studies of active ingredients have documented lethal effects, and to a lesser degree sublethal effects, on select species. These studies are typically laboratory derived, and findings may vary greatly. For example, pyrethroid LC_{50} concentrations for salmonids have been shown to vary three-orders of magnitude (Table 5). Furthermore, while individual chemicals are tested, most chemical formulations (combinations of active and inert ingredients or several chemical products) have not been tested for effects on species. Field conditions may provide some ameliorating circumstances that may reduce exhibited chemical toxicity. Smith and Stratton (1986) state, "field applications usually have no pronounced effects on *in situ* fish survival." The myriad of possible chemical/species interactions frequently necessitate that chemical classes and/or species groups be assessed to estimate potential effects of a specific chemical on a particular species.

Table 4. Statistical Summaries of Precipitation at Cottage Grove and Runoff Patterns from the Siuslaw River near Mapleton, Oregon (source: BLM 2002a).

Month	Mean Monthly Precipitation (inches)	Annual Runoff (%)	Mean Runoff Per Sq. Mile* (cfs/sq. mile)
October	3.60	1.8	0.76
November	7.46	9.7	4.29
December	7.20	20.9	8.95
January	6.53	19.8	8.50
February	5.20	17.0	8.01
March	5.38	14.0	6.00
April	3.53	8.1	3.60
May	2.53	4.1	1.76
June	1.39	2.2	0.96
July	0.53	1.1	0.46
August	0.95	0.6	0.27
September	1.65	0.7	0.34

* derived from mean monthly flows

Furthermore, there is currently a question of the adequacy of using LC_{50} values to predict adverse effects in the context of the ESA. Conventional toxicity studies, including the LC_{50} experimental paradigm, may underestimate neurobehavioral thresholds for fish (Scholz *et al*. 2000). Rainbow trout (*Oncorhynchus mykiss*) behavior changed at chlordane (organochlorine insecticide) concentrations below the U.S. Environmental Protection Agency's (EPA) not-to-be-exceeded concentration, illustrating the inadequacy of using current EPA application guidelines for avoidance of sublethal effects (Little *et al*. 1990).

1.5.2 Effects of Asana on Aquatic Life

Asana (EPA Reg. No. 352-515), produced by DuPont, is comprised of esfenvalerate (8.4%) and inert ingredients (91.6%), including two potentially toxic substances that have a high priority with the EPA for testing: xylene (<3%) and ethylbenzene (<1%). The remaining inert ingredients (>87.6%) in the Asana formulation are proprietary information and remain unidentified.

Esfenvalerate is a synthetic pyrethroid insecticide and is registered as a moderately toxic insecticide for use for forestry, range, conifer seed orchards, forest tree nurseries, and right-of-way pest control. Esfenvalerate is a sodium channel blocker that kills insects on contact or ingestion. Non-target insects may similarly be affected.

Pyrethroids, including esfenvalerate, are highly toxic to fish and aquatic invertebrates (Moore and Waring 2001, Tanner and Knuth 1996, Little *et al*. 1993, Eisler 1992, Smith and Stratton 1986, Curtis *et al*. 1985). Eisler (1992) states that though few environmental problems to aquatic organisms have been documented from the use of synthetic pyrethroid insecticides, extreme caution is warranted when used within an endangered species' habitat.

Table 5. Lethal Effect Concentrations for Pyrethroid Insecticides on Fish.

Coho Salmon
- 96 hr LC_{50} = 22.2 ppb allethrin (Mauck *et al*. 1976).

Rainbow Trout
- 24 hr LC_{50} = 3.8 ppb fenvalerate (Mulla *et al*. 1978).
- 24 hr LC_{50} = 4.7 ppb fenvalerate (Holcombe *et al*. 1982).
- 24 hr LC_{50} = 76 ppb fenvalerate (Coats and O'Donnell-Jeffrey 1979).

- 48 hr LC_{50} = 3.0 ppb fenvalerate (Mulla *et al*. 1978).

- 96 hr LC_{50} = 0.088 ppb fenvalerate (Curtis *et al*. 1985).
- 96 hr LC_{50} = 0.26 ppb esfenvalerate (DuPont 2002).
- 96 hr LC_{50} = 0.32 ppb flucythrinate (Worthing and Walker 1983).
- 96 hr LC_{50} = 2.1 ppb fenvalerate (Holcombe *et al*. 1982).
- 96 hr LC_{50} = 17.5 ppb allethrin (Mauck *et al*. 1976).

Atlantic Salmon
- lethal threshold = 0.46 ppb fenvalerate (McLeese *et al*. 1980).
- 96 hr LC_{50} = 1.2 ppb fenvalerate (McLeese *et al*. 1980).

Bluegill Sunfish
- 96 hr LC_{50} = 0.26 ppb esfenvalerate (DuPont 2002).
- 96 hr LC_{50} = 0.31 ppb esfenvalerate (Fairchild *et al*. 1992)

Common Carp
- 96 hr LC_{50} = 1.0 ppb esfenvalerate (Extoxnet 2002).
- 96 hr LC_{50} = 1.2 ppb fenvalerate (McLeese *et al*. 1980).

NOAA Fisheries was unable to locate an esfenvalerate LC_{50} concentration for coho salmon, however, all pyrethroids illicit toxicity by blocking neural voltage-activated sodium/calcium channels. Therefore, in the absence of more specific esfenvalerate information, other pyrethroids may be useful in evaluating toxicological responses. Approximately 40% of the pyrethroid LC_{50} values for fish are $\leq$1.0 part per billion (ppb) (Smith and Stratton 1986). According to the BA, a comparative study between coho salmon and steelhead trout showed that both species were similarly affected by five pyrethroids, with steelhead trout being slightly more sensitive (Mauck *et al*. 1976). This study appears to valididate the use of other pyrethroids as surrogates for evaluating esfenvalerate toxicity. Simultaneously, this suggests that steelhead trout and other salmonids may function sufficiently as surrogates in the absence of coho salmon information.

The only esfenvalerate LC_{50} known for a salmonid is a 96-hour LC_{50} of 0.26 ppb for rainbow trout (DuPont 2002). Curtis *et al*. (1985) found a 96-hour fenvalerate LC_{50} concentration for alevin rainbow trout of 0.088 ppb.

The majority of pyrethroid EC_{50} and LC_{50} values for aquatic invertebrates, including many salmonid prey species, are less than 1.0 ppb (Smith and Stratton 1986). Esfenvalerate and fenvalerate, in particular, are highly toxic (Table 6). The esfenvalerate 48-hour LC_{50} for *Daphnia magna* is 0.9 ppb (DuPont 2002). The LC_{50} concentration of fenvalerate, a pyrethroid insecticide for mayflies, ranges from 0.08-0.93 ppb (Smith and Stratton 1986). Fenvalerate applied at mosquito larvicidal rates of 0.025 to 0.01 pounds per acre (lbs/ac) completely or markedly reduced abundance of mayfly and dragonfly naiads for 2 to 3 weeks (Smith and Stratton 1986). Minimum concentrations that elicit sublethal responses also are low. Fenvalerate concentrations as low as 0.022 ppb caused behavioral changes in amphipods and mayflies (Smith and Stratton 1986). The EC_{50} for mayfly swimming ability is 0.07 to 0.31, and the 72-hour EC_{50} for stonefly immobilization is 0.13 ppb (Smith and Stratton 1986).

Asana entering the water via drift or spill may kill invertebrates and reduce available food supplies for fish and other aquatic organisms. Sublethal effects may cause downstream drift of invertebrates and increase their risk to predation as their mobility is compromised. If exposure is limited to a short-duration pulse, reductions in the sizes of aquatic invertebrate populations are likely to be transitory (4 to 6 weeks) as re-colonization from upstream populations restore the community.

Terrestrial invertebrates are also important coho salmon prey species. Terrestrial insects may represent 40% (dry weight) of food consumed by coho salmon in small, densely shaded streams (Groot and Margolis 1991). As with other species groups, the effect of the proposed application on terrestrial prey species will be dependent on the degree of species selectivity of Asana and the differences in sensitivity of the different terrestrial invertebrates. The manufacturer of Asana indicates its effectiveness in controlling caterpillars, maggots, worms, aphids, midges, and flies (DuPont 2002). In general, since terrestrial insects are the targeted organisms, significant lethal effects are expected in areas that are treated.

Table 6. Effect Concentrations for Esfenvalerate and Fenvalerate on Aquatic Invertebrates.

Chemical	**Species**	**Toxicity Criterion**	**Value (ppb)**
Esfenvalerate	*Daphnia magna*	48-hour LC_{50}	0.9
Fenvalerate	Amphipod	24 to 96-hour LC_{50}	0.03-0.13
Fenvalerate	Mayfly	24 to 96-hour LC_{50}	0.08–0.93
Fenvalerate	Mayfly	EC_{50} - swimming ability	0.07-0.31

Fenvalerate	Copepod	96-hour LC_{50}	1.4-2.7
Fenvalerate	Stonefly	72-hour EC_{50} - immobilization	0.13

Sublethal effects in fish have been documented at recommended rates of application (Smith and Stratton 1986). As stated in Smith and Stratton (1986), "Pyrethroids are lipophilic and are likely to be strongly absorbed by the gills, even from water containing very low pesticide concentrations." While little is known regarding the sublethal effects of esfenvalerate on coho salmon in particular, the sublethal effects of pyrethroids on fish in general include abnormal swimming, a reduced startle response, loss of equilibrium, body tremors, altered metabolic processes, growth, and depressed olfactory function (BLM 2002a). These effects may impair an exposed fish's abilities to acquire prey, avoid predators, and achieve reproductive success. A recent study of a synthetic pyrethroid insecticide on Atlantic salmon (*Salmo salar*) found inhibition of male parr olfactory response following a 5-day exposure to concentrations of less than 0.004 ppb or 4 parts per trillion (Moore and Waring 2001). The same study found exposure of milt and eggs to a concentration of 0.1 ppb reduced egg fertilization. Bluegill (*Lepomis macrochirus*) exposed to pulses of low esfenvalerate concentrations (0.025 ppb) exhibited behavioral responses including gross body tremors within 4 hours (Little *et al.* 1993). Esfenvalerate may bioaccumulate in the tissues of fish and other aquatic organisms, but is not known to biomagnify. Synthetic pyrethroid insecticides are rapidly eliminated from tissue after discontinuation of exposure and do not biomagnify through the food chain (Smith and Stratton 1986).

The BLM literature review in the BA included numerous studies documenting pyrethroid sublethal effects. References cited in the below excerpt can be found on pages 68-71 of the BA (BLM 2002a).

> Rainbow trout exposed to 0.00075 mg/L [*0.75 ppb*] permethrin (5% of the 96-hr LC_{50} value) showed a substantial decrease in swimming performance which was related to exposure time (1 to 43 days). [...] Japanese medaka (*Oryzias latipes*) exposed to permethrin above 0.009 mg/L [*9 ppb*]swam hyperactively with excessive lateral flexure in the caudal area within 24 [*hours*] (Rice *et al*. 1997). After 24 [*hours*] of exposure, severely intoxicated fish became hyperactive, under reactive to startle stimuli, and mortality eventually resulted. Swimming stamina of brook trout (*Salvelinus fontinalis*) was decreased after a 6-[*hour*] 0.0063 mg/L [*6.3 ppb*] resmethrin exposure (Paul *et al*. 1996).
>
> Gross body tremors of juvenile bluegill (*Lepomis macrochirus*) continually or pulse-exposed to esfenvalerate were highly sensitive indicators of toxicity at concentrations as low as 0.000025 mg/L [*0.025 ppb*] (Little *et al*. 1993). Aggression was also significantly lowered among fish exposed to pulsed esfenvalerate concentrations of 0.0001 mg/L [*0.1 ppb*] or greater.

> Juvenile Atlantic salmon exposed to 20 nmol/L (0.008 mg/L [*8 ppb*]) fenvalerate for 70 [*hr*] had an additional stress upon feeding, which eventually resulted in death (Haya 1989). The rate of oxygen consumption of *Tilapia mossambica* was greatly reduced with increasing concentrations of esfenvalerate (0.02 to 0.1 mg/L [*20 to 100 ppb*]) after 48 [*hr*] (Radhaiah and Rao 1990). Muscle glycogen content was also significantly decreased, suggesting an altered metabolism and disturbing the metabolic process of this organ. A similar result was found with Chinese grass carp (*Ctenopharyngodon idella*) when exposed to 0.005 mg/L [*5 ppb*] fenvalerate [*for*] 1 to 4 [*weeks*] (Shakoori *et al*. 1996)
>
> Fenvalerate concentrations > 0.002 mg/L [*>2 ppb*] reduced standard lengths of sheepshead minnow fry (*Cyprinodon variegatus*), and survival was lessened at concentrations > 0.004 mg/L [*>4 ppb*] (Hansen *et al*. 1983) over a period of 28 days. Affected fish were lethargic, rested in a curled position and ate infrequently.

The persistence of esfenvalerate varies upon environmental conditions with half-lives in direct sunlight, soil, and water being 7.5 days, up to 90 days, and 10 to 220 days, respectively. At least one study found pyrethroids are "relatively non-persistent and do not accumulate in the environment" (Smith and Stratton 1986). Chapman *et al*. (1981) applied 1 part per million of the pyrethroid fenvalerate to mineral and organic soils. Eight weeks after application, 12% of the applied fenvalerate remained in the mineral soil sample, and 58% remained in the organic soil sample. Another study that applied Asana (esfenvalerate) in two applications, 30 days apart, directly to littoral enclosures found maximum water concentrations within 1 to 3 hours after application, and only 10% remained after 24 hours (Heinis and Knuth 1992). Esfenvalerate concentrations were undetectable (0.047 ppb) in water within 4 days. And yet, the same littoral enclosure study found: "Water and sediment, and, to a lesser extent, aquatic vegetation and macrophytes, were important reservoirs for esfenvalerate" (Heinis and Knuth 1992). In general, soil organisms and photodegradation breakdown esfenvalerate in the environment producing carbon dioxide, acid, and alcohol. Some breakdown products may be more toxic than the active ingredient. Esfenvalerate readily binds to organic matter in the soil, has little mobility, and is practically insoluble in water. The potential for leaching into groundwater is very low.

The BLM used the Quotient Method (EPA 1986) in their BA to evaluate esfenvalerate's risk to OC coho salmon. However, the method is based on lethal response and assumes that the dose/response curve resembles a *typical* curve produced from a toxicological model presented in the 1975 Regulations for the Enforcement of the FIFRA (40 CFR 154). Furthermore, the EPA (1986) states that the procedure does not indicate the "probability of adverse effects," and that they "view the risk of criteria with their safety factors as 'rough' estimates of potential risk to non-target species." Similarly, NOAA Fisheries does not currently recognize this method as being sufficiently protective of ESA-listed species. In the context of this consultation and given the lack of more specific information to the contrary, NOAA Fisheries considers the 1/20th value procedure as a conservation measure that attempts to minimize, though not avoid, lethal effects in coho salmon. NOAA Fisheries will use the 1/20th value in conjunction with the LC_{50} value and the most conservative sublethal effect concentration available in the literature to assist in evaluating the effects of the proposed action.

Based on the available literature regarding effects of pyrethroids on salmonids, NOAA Fisheries elects to use 0.004 ppb for the sublethal esfenvalerate concentration based on Moore and Waring (2001), 0.088 ppb for the juvenile lethal esfenvalerate concentration based on Curtis *et al*. (1985), and 0.26 ppb for the adult lethal esfenvalerate concentration based on DuPont (2002) (Table 7). The BLM also elected to use these concentrations when completing their evaluation of effects. NOAA Fisheries believes these concentrations are appropriate until more comprehensive testing is completed to definitely determine the salmonid lethal and sublethal thresholds for Asana. The 1/20th values for lethal effect in juvenile and adult life-forms are therefore 0.0044 ppb and 0.013 ppb, respectively.

Table 7. Sublethal and Lethal Esfenvalerate Concentrations Selected for Evaluating the Effects of the Proposed Action.

Lifestage	Sublethal Concentration (ppb)	Lethal Concentration (ppb)	1/20th Lethal Conc. (ppb)
Adult salmonids	0.004	0.26	0.013
Juvenile salmonids	0.004	0.088	0.0044
Aquatic invertebrates	0.07	0.03	0.0015

Ethylbenzene and xylene, the two identified inert ingredients in Asana, are moderately toxic to fish. Ethylbenzene is most commonly found in vapor form since it moves easily into the air from water and soil. In the air, ethylbenzene is broken down by sunlight in approximately 3 days. In surface water, it breaks down by reacting with other compounds. In soils, ethylbenzene is broken down by bacteria. Xylene very quickly evaporates into the air from surface water and soil where it may remain for several days until it is broken down by sunlight. Because xylene is applied as a liquid, it does have the potential to infiltrate into the soil. Most xylene in surface water evaporates into the air in less than a day. Xylene is more persistent in groundwater where evaporation is impaired.

The BLM literature review included in the BA documented the following toxicity information for ethylbenzene and xylene. References cited in the excerpt can be found on pages 68-71 of the BA (BLM 2002a).

> The 96-[*hour*] LC_{50} of ethylbenzene reported for rainbow trout (*Oncorhynchus mykiss*) is 4.2 to 14 mg/L [*4,200 to 14,000 ppb*] (Row, Landrigan, and Lopes, 1997). The 24-[*hour*] LC_{50} of the xylenes for rainbow trout (o, m, p- isomers) are

8.1, 8.4, and 2.6 mg/L [*8,100 ppb, 8,400 ppb and 2,600 ppb*], respectively (Row, Landrigan, and Lopes, 1997).

For young coho salmon (*Oncorhynchus kisutch*) the 96-[*hour*] LC_{50} for xylene is between 10 to 100 mg/L [*10,000 to 100,000 ppb*]. Toxic signs included rapid, violent and erratic swimming, coughing, loss of equilibrium and death (Morrow *et al*. 1975). A behavioral study with coho salmon showed that xylene (o-) was avoided at > 0.2 mg/L [>*200 ppb*] (Maynard and Weber 1981).

Limited information is available regarding chronic exposure of aquatic organisms to ethylbenzene and xylenes, however, the histopathologic changes induced by xylene on the gills of *Tilapia zillii* after 7, 21 and 30 days included drooping and curling of the filaments and lamellae, hyperplasia and lifting of lamellar epithelium, fusion of the lamellae and filaments and necrosis in varying degrees. The gills showed a progressive damage with prolonged exposure (El-Sayed, Moursy, and Ibrahim 1995).

Based on the available literature for effects of ethylbenzene and xylene on salmonids, NOAA Fisheries elects to use 200 ppb for the sublethal xylene concentration, 2,600 ppb for the lethal xylene concentration, and 4,200 ppb for the lethal ethylbenzene concentration (Table 8). No information on specific sublethal effects concentrations are available for ethylbenzene.

Table 8. Ethylbenzene and Xylene Sublethal and Lethal Concentrations for Salmonids Selected for Evaluating the Effects of the Proposed Action.

Chemical	**Sublethal Concentration (ppb)**	**Lethal Concentration (ppb)**	**1/20th Lethal Conc. (ppb)**
Ethylbenzene	not available	4,200 (96-hr LC_{50})	210
Xylene	200	2,600 (24-hr LC_{50}) 10,000 (96-hr LC_{50})	130 500
Macro invertebrates	0.07	0.03	0.0015

1.5.3 Vectors of Exposure

1.5.3.1 Drift

General.
Direct effects resulting from Asana are predominately associated with contamination of waterways resulting from drift. Drift is primarily dependent on gravity, air movement, and droplet size (NebGuide website at <http://www.ianr.unl.edu/pubs/pesticides/g1001.htm>). Smaller droplets stay aloft longer, and the longer a droplet is suspended the greater the potential for translocation by air currents. In still air a droplet size of 100 microns (mist) takes 11 seconds to fall 10 feet. The same size droplet would travel 15.4 feet in a 1 mph wind while dropping the same height (10 feet), and 77 feet at 5 mph (NebGuide website). Application pressure, nozzle size, nozzle type, spray angle, spray volume are all factors in determining droplet size. In general, droplet sizes increase with decreasing pressure and larger nozzle sizes. An indicated droplet size (*i.e.*, 300 microns) really represents a median diameter of all droplets. Actual droplet sizes will range from considerably smaller as well as larger than the indicated droplet size. During temperature inversions little vertical air mixing occurs and drift can translocate contaminates several miles (NebGuide website). In addition, low relative humidity and/or high temperature conditions will increase evaporation and the potential for drift. Proposed buffers, application criteria, and concurrent drift monitoring will minimize this risk. Cessation of ground-based application will occur if drift cards indicate deposition is threatening adjacent streams.

Aerial Application Method.
In evaluating drift effects to non-target species, the BLM relied on a risk assessment completed by Labat-Anderson, Inc. (BLM 2002b). The Risk Assessment modeled aerial application drift using AgDRIFT, a cooperative model developed by the EPA Office of Research, the USDA Agricultural Research Service, the USDA Forest Service, and the Spray Drift Task Force. The modeling was not completed specifically for the proposed action, but rather for certain scenarios that called for treating a much greater area than the 29 acres currently proposed. However, Stream 8 and on-site stream segments were used for the risk assessment modeling. Modeling was done to edge of field; therefore, the filtering effect of vegetative buffers between orchard units and streams was not considered for drift calculations. Modeling was completed using the parameters found in Table 9.

Table 9. Input Parameters for the Risk Assessment AgDRIFT Modeling.

Parameter	Typical Scenario	Maximum Scenario
Helicopter	Hiller Soloy Turbine	Hiller Soloy Turbine
Flight Speed	50 mph	50 mph

Parameter	Typical Scenario	Maximum Scenario
Spray Boom's Forward Position from Rotor Shaft Plane	10 ft.	10 ft.
Nozzle Extension Relative to the Rotor Diameter	75%	75%
Nozzles	Spraying Systems D8-46	Spraying Systems D8-46
Boom Height above Canopy	15 ft.	15 ft.
Swath Width	45 ft.	45 ft.
Wind Speed	3 mph	6 mph
Temperature (April 15)	40°f	40°f
Relative Humidity (April 15)	75%	75%

Despite the fact that modeled scenarios exceeded the proposed treatment acreage and the inability for the model to account for conservation measures (*e.g.*, buffers, no stream crossings in the flight pattern), aerial application drift modeling indicated very little Asana ingredients are likely to reach the stream network or concentrate in Stream 8 via drift (Table 10). Modeled values were two orders of magnitude less than the selected esfenvalerate sublethal concentration for salmonids and the juvenile $1/20^{th}$ lethal concentration value as presented above in section 1.5.2 of this Opinion (*Effects of Asana on Aquatic Life*).

Table 10. Risk Assessment Modeled Stream Concentrations of Asana Components Under the Proposed Action Resulting from Application Drift, and Salmonid Effect Concentrations Selected by NOAA Fisheries for Effects Evaluation.

Application Method	Chemical	Stream Concentration (ppb)	Sublethal Effect Concentration (ppb)	Lethal Effect Concentration (ppb)	$1/20^{th}$ Lethal Concentration (ppb)
Aerial	Esfenvalerate	0.0000758	0.004	0.088 juvenile 0.26 adult	0.0044 0.013

	Ethylbenzene	0.00000902	NA	4,200	210
	Xylene	0.0000638	200	2,600 (24-hr LC_{50}) 10,000 (96-hr LC_{50})	130 500
Ground-based	Esfenvalerate	-0-	0.004	0.088 juvenile 0.26 adult	0.0044 0.013
	Ethylbenzene	-0-	NA	4,200	210
	Xylene	-0-	200	2,600 (24-hr LC_{50}) 10,000 (96-hr LC_{50})	130 500

Ground-based Application Method
Drift from ground-based, high-pressure hydraulic sprayers was estimated in the BLM risk assessment based on a study by Haverty et.al. (1983, as cited in BLM 2002a), which measured drift deposition at five distances from treated trees. The risk assessment found no drift deposition at a distance of 12 meters (39.3 feet) from the treatment boundary, the farthest distance evaluated. Given the proposed 200-foot no-treatment buffer on area streams, the BLM does not expect drift to reach area waterways from this application method (Table 10).

1.5.3.2 Runoff and Leaching

The BLM indicated in the BA that potential runoff events which occur within the first 6 months after spray application have the highest probability of affecting aquatic life, and that runoff events within the first 72 hours of application were the most important in terms of increases in detectable concentrations in ppb. Post-application direct effects may occur in association with rain that may transport the chemicals to waterways, which will convey them downstream to coho salmon habitat. The adsorption potential, stability, solubility, and toxicity of a chemical determines the extent to which it will migrate and adversely effect surface waters and groundwater (Spence *et al*. 1996). The insolubility and strong adsorbing characteristics of esfenvalerate make this chemical unlikely to leach through soils; if sediment transport is precluded, transport to waterways should be minimal. In addition to the insolubility of esfenvalerate, the Tyrrell soils further reduce the likelihood of leaching taking place. The soils are silty-clay loams and silty-loams of the hydrological soil group C, which are characterized as slow infiltration when wet, slow rate of water transmission, and fine to fine-moderate particle size. However, the low (Dupee soil) to moderate (Bellpine soil) organic matter content of the Tyrrell Orchard soils suggest the esfenvalerate adsorption potential may be limited. The high toxicity and persistence of esfenvalerate means the chemical remains a significant contamination threat for sometime after application, maybe well into the fall wet season.

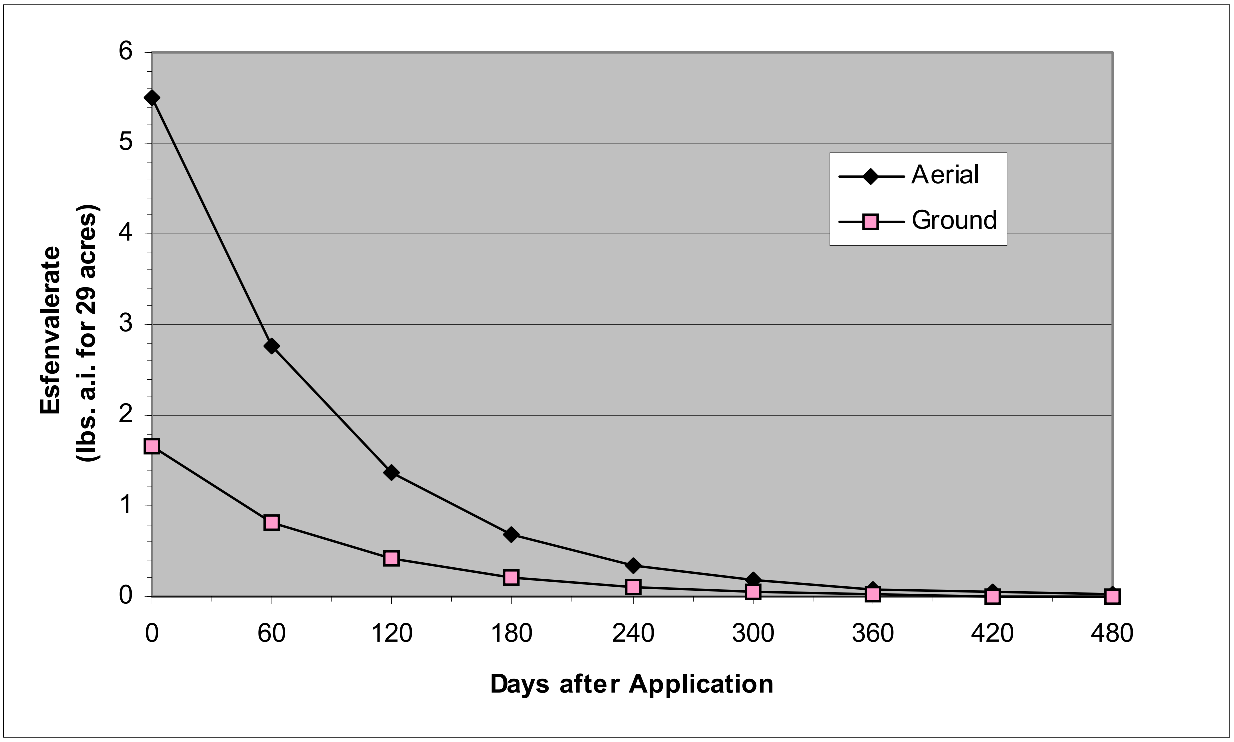
Esfenvalerate may persist within the treatment units for more than a year (Figure 1). Figure 1 compares the persistence by application method of esfenvalerate on the spray units. The vertical axis shows the number of pounds of esfenvalerate that would be applied to the entire 29 acre project area (0.057 lbs. a.i./acre ground based * 29 acres = 1.653 lbs. a.i./29 acres). The difference between the two methods becomes negligible at 420 days, relative to the scale of the chart. Since the proposed application rate for aerial application (0.19 lbs. a.i./acre) is higher than for ground-based application (0.057 lbs. a.i./acre), there would be 3.3 times the esfenvalerate mass throughout the degradation period. Esfenvalerate applied aerially would also persist longer since more is initially applied.

The BLM assessed runoff and leaching from the proposed action using the Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) and the Method of Characteristics (MOC) models.

The GLEAMS model, developed by the USDA Agricultural Research Service, is a computerized mathematical model developed for field-sized areas to evaluate the movement and degradation of chemicals within the plant root zone under various crop management systems. The model has been tested and validated using a variety of data on pesticide movement. A more detailed discussion of the GLEAMS model can be found in the BA.

GLEAMS will model the concentration of chemical that will leave a target field, in this case an orchard block, that is transported by overland flow or that is adsorbed to soil particles that are transported in the flow. The model is not able to predict chemical concentrations reaching streams separated from the target fields by buffer areas.

Figure 1. Esfenvalerate Persistence by Application Method for the 2003 Spray Project.



To account for the attenuating affect of buffer zones, the MOC model developed by the U.S. Geological Survey was used. This is a two-dimensional groundwater flow and chemical transport model, and it computes changes in concentration over time, accounting for the processes of dispersion, adsorption, and degradation.

Mobility of Asana from orchard units is limited by the absence of overland flow sufficient to detach soil particles and transport both soil particles or organic matter. GLEAMS modeling reveals the most likely scenario of runoff contamination to be in response to storms the winter following application. Modeled esfenvalerate concentrations attributed to aerial application were one order of magnitude less than the selected sublethal effects value. Due to a combination of conservation measures including sediment retention structures in swales, aeration of the downslope field perimeters, and no-treatment buffers, NOAA Fisheries expects very little Asana ingredients (those that have been identified) to reach the channel network and concentrate in Stream 8 (Table 11). Again, these values were taken from the risk assessment and were based on more acres than are proposed for the subject treatment. Therefore, NOAA Fisheries considers these values higher than likely to occur given the on-the-ground conditions.

Modeled aerial and ground-based application values were one and two orders of magnitude, respectively, less than the selected esfenvalerate sublethal concentration for salmonids and the juvenile 1/20th lethal concentration value as presented above in section 1.5.2 (*Asana*® *XL*).

Table 11. Risk Assessment Modeled Stream Concentrations of Asana Components Under the Proposed Application Alternatives Resulting from Runoff and Erosion, and Salmonid Effect Concentrations Selected by NOAA Fisheries for Effects Evaluation.

Application Method	Chemical	Stream Concentration (ppb)	Sublethal Effect Concentration (ppb)	Lethal Effect Concentration (ppb)	1/20th Lethal Concentration (ppb)
Aerial	Esfenvalerate	0.000149	0.004	0.088 juvenile 0.26 adult	0.0044 0.013
	Ethylbenzene	0.000000766	NA	4200	210
	Xylene	-0-	NA	2,600 (24-hr LC_{50}) 10,000 (96-hr LC_{50})	130 500
Ground-based	Esfenvalerate	0.0000391	0.004	0.088 juvenile 0.26 adult	0.0044 0.013
	Ethylbenzene	-0-	NA	4200	210
	Xylene	-0-	NA	2,600 (24-hr LC_{50}) 10,000 (96-hr LC_{50})	130 500

Due to the low solubility and propensity to adsorb to soil, NOAA Fisheries expects no esfenvalerate to move into streams via ground water. In addition, NOAA Fisheries expects no ethylbenzene or xylene to move into streams via groundwater since they rapidly volatilize and degrade.

1.5.3.3 Exposure Summary

During the period the BLM proposes to apply Asana (April or early May), the most sensitive coho salmon lifestages will be present in the action area (*e.g.*, eggs, alevin, fry, smolt). Therefore, these life stages may be exposed to Asana from drift and/or runoff. Juveniles may remain present in the action area throughout the year and exposed repeatedly. Due to life-history timing, NOAA Fisheries does not anticipate adult coho salmon in the action area until four or five months after application. Therefore, adult exposure would likely be limited to Asana-contaminated storm-water runoff. Additionally, coho salmon prey species (aquatic and terrestrial) will be present in the action area during the potential exposure period.

While the BLM risk assessment indicated the proposed Asana application may alter the existing water quality, NOAA Fisheries expects that implementation of project conservation measures as described above in section 1.2 (Proposed Action) would minimize the risk that esfenvalerate or other known Asana components would reach downstream coho salmon populations in concentrations sufficient to elicit significant sublethal or lethal effects. Application buffers and drift monitoring should minimize drift contamination. Vegetated buffer strips and soil aeration should maximize infiltration rates and minimize over-ground flow. The soils should contain the pesticides until biodegradation and decay renders the chemicals impotent, and the grass cover should prevent erosion. Silt fencing and sand traps should minimize off-site transport of any mobilized esfenvalerate-contaminated organics.

The analysis presented above does not consider the exposure risk that would be incurred due to the lengthy application period required under the ground-based application method. Ground-based spraying would require an estimated 27 hours spread over approximately 6 to 8 days. Aerial spraying can accomplished within a 1-hour period on a single day. The longer application period would put aquatic organisms at risk for a longer period and increase the likelihood of unfavorable weather conditions, equipment error, and operator error occurring during application.

1.5.4 Relevant Monitoring Results

The BLM completed aerial esfenvalerate applications at the Horning Seed Orchard in 2001 and 2002. Despite overall compliance and implementation of design criteria, 2001 monitoring results indicated detectable esfenvalerate concentrations in two waterways adjacent to the treatment areas (BLM 2002c). In one stream contamination was noted in the 15-minute and 2-hour post-treatment water samples. Subsequent samples found no detectable levels of esfenvalerate. The detection limit was 0.02 ppb, which exceeds the pyrethroid sublethal effects threshold of 0.004 ppb. Therefore, any detectable concentration suggests sublethal effects are possible. The 0.4 ppb esfenvalerate concentration noted in the 15-minute sample exceeded the 96-hour LC_{50} value for fry (0.088 ppb) and adult trout (0.26 ppb). The 2-hour sample (0.061 ppb) decreased to below the 96-hour LC_{50} values, although the concentration was within the same order of magnitude as the established 96-hour LC_{50} value for fry (0.088 ppb). Concentrations rapidly attenuated and the exposure duration was limited (<4 hours). In the other stream, contamination was noted in the 2-hour sample (0.032 ppb). Contamination was largely attributed to drift associated with flight operations. Prior to the 2002 Horning Seed Orchard application, adjustments were made to the flight patterns and application methods. As of this writing, no waterway contamination has been reported in association with the 2002 application. The subject action at Tyrrell Orchard has incorporated many of the same measures used at the Horning Seed Orchard during 2002.

1.5.5 Summary of Effects of the Proposed Action

Modeling of the proposed Asana insecticide application indicates OC coho salmon and aquatic prey species will not be exposed to concentrations of esfenvalerate and known inert ingredients sufficient to cause lethal and sublethal effects. In unintentionally treated riparian areas, NOAA Fisheries expects temporary reductions in terrestrial prey species. Specific data are not available to provide a greater degree of certainty of the actual effects likely to occur. Modeled concentrations are within one to three orders of magnitude of potential effect concentrations, which is within the range of demonstrated effects-concentration variability. In such cases, NOAA Fisheries prescribes to the precautionary principle and elects to give the benefit of the doubt to ESA-listed species. NOAA Fisheries has sufficient reason to believe that the listed species is likely to be adversely affected by the proposed action because: (1) Esfenvalerate elicits sublethal and lethal effects at extremely low concentrations; (2) the most sensitive lifestages of coho salmon are likely to be present in the action area; (3) modeled concentrations were within one to two degrees magnitude of sublethal effects concentrations; (4) sublethal effects may occur below detection limits; (5) that a significant fraction (>87.6%) of the Asana ingredients have not been identified and evaluated; and (6) that the implementation of a similar action resulted in aquatic contamination. NOAA Fisheries expects adverse effects to consist of sublethal behavior modification.

The adverse effects from the proposed project are not likely to be of a magnitude, extent, or duration that would appreciably reduce survival of the listed species due to the following considerations: (1) The proposed action will occur approximately 500 feet upstream of habitat occupied by OC coho salmon; (2) 200-foot minimum no-spray buffers will be used around all hydrologically-connected surface waters present at the time of application; (3) spraying will not occur over water bodies; (4) wind limits and drift monitoring will minimize the risk of direct contamination of waterways; (5) precipitation forecast limits, soil aeration, silt fences, and sand traps will minimize the risk of indirect water contamination via ground transport; (6) vegetative ground cover will minimize risk of erosion and contaminated sediment transport; (7) staging areas are located well away from water on ridgetops; (8) aerial application flight paths will not cross streams; (9) esfenvalerate binds strongly with soils and is not water soluble; (10) esfenvalerate is broken down by sunlight and microorganisms; (11) known inert ingredients are volatile and will not be available to enter waterways; (12) no new roads or vegetation removal are proposed; and (13) existing natural riparian buffers are present to assist in the protection of downslope water quality.

1.5.6 Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as those effects of "future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." Future Federal actions, including the ongoing operation of hydropower systems, hatcheries, fisheries, and land management activities are being (or have been) reviewed through separate section 7 consultation processes. Therefore, these actions are not considered cumulative to the proposed action.

NOAA Fisheries is not aware of any specific future non-federal activities within the action area that would cause greater impacts to listed species than presently occurs. However, the adjacent lands are in private timber production. The use of chemical fertilizers or pesticides as part of normal forest practice may occur, but no specific information is known regarding their use. Furthermore, NOAA Fisheries does not consider the regulations governing timber harvests on non-federal lands within Oregon to be sufficiently protective of stream and riparian habitats. Therefore, those habitats are at risk from future harvests on non-federal lands within the basin.

1.6 Conclusion

After reviewing the current status of OC coho salmon, the environmental baseline for the action areas, the effects of the proposed insecticide application and cumulative effects, NOAA Fisheries has determined that the proposed Asana insecticide application at the Travis Tyrrell Seed Orchard is not likely to jeopardize the continued existence of the OC coho salmon. In summary, our conclusion is based on the following considerations: (1) The proposed action will occur approximately 500 feet upstream of habitat occupied by OC coho salmon; (2) 200-foot minimum no-spray buffers will be used around all hydrologically-connected surface waters present at the time of application; (3) spraying will not occur over water bodies; (4) wind limits and drift monitoring will minimize the risk of direct contamination of waterways; (5) precipitation forecast limits, soil aeration, silt fences, and sand traps will minimize the risk of indirect water contamination via ground transport; (6) vegetative ground cover will minimize risk of erosion and contaminated sediment transport; (7) staging areas are located well away from water on ridgetops; (8) aerial application flight paths will not cross streams; (9) esfenvalerate binds strongly with soils and is not water soluble; (10) esfenvalerate is broken down by sunlight and microorganisms; (11) known inert ingredients are volatile and will not be available to enter waterways; (12) no new roads or vegetation removal are proposed; and (13) existing natural riparian buffers are present to assist in the protection of downslope water quality.

NOAA Fisheries expects implementation of the monitoring plan as a whole to provide better information about the potential for offsite-transport of contaminants.

1.7 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary measures suggested to minimize or avoid adverse effects of a proposed action on listed species, to minimize or avoid adverse modification of critical habitat, or to develop additional information.

A review of aerial versus ground-based application suggests that aerial application may pose the lesser overall risk to aquatic resources. While aerial application will deliver 3.3 times the amount of esfenvalerate on the landscape, ground-based application will result in spraying 27 times longer, require mixing the chemical 8.25 times more, and generate 2.6 times the estimated drift deposition (Table 1). These factors appreciably increase the risk of implementation error and opportunities for contamination to occur. This evaluation is predicated upon the understanding that BLM will implement the project as proposed, that project design criteria are sufficient to prevent transport by precipitation runoff, and that drift remains the most difficult aspect of the project to control.

The NOAA Fisheries recommends that:

1. BLM make every effort to minimize the amount of insecticide used.

2. As the action is proposed, BLM use aerial application preferentially to ground-based application.

3. BLM complete testing of Asana on coho salmon juveniles to establish a sublethal toxicity threshold and an LC_{10} value.

In order for NOAA Fisheries to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, NOAA Fisheries request notification of the implementation of any conservation recommendations.

1.8 Reinitiation of Consultation

This concludes formal consultation on these actions in accordance with 50 CFR 402.14(b)(1). The BLM must reinitiate consultation if: (1) The amount or extent of incidental take is exceeded; (2) the action is modified in a way that causes an effect on the listed species that was not previously considered in the biological assessment and this Opinion; (3) new information or project monitoring reveals effects of the action that may affect the listed species in a way not previously considered; or (4) a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16). In instances where the amount or extent of authorized incidental take is exceeded, any operations causing such take must cease pending conclusion of the reinitiated consultation.

2. INCIDENTAL TAKE STATEMENT

Section 9 and rules promulgated under section 4(d) of the ESA prohibit the take of endangered species and threatened species, respectively, without special exemption. “Take” is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct. “Harm” is further defined by NOAA Fisheries to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, and sheltering (50 CFR 217.12). “Incidental” take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to, and not intended as part of, the agency action is not considered to be a prohibited taking under the ESA provided that such taking is in compliance with the term and conditions of this incidental take statement.

2.1 Amount or Extent of Take

NOAA Fisheries anticipates that the proposed action covered by this Opinion is reasonably certain to cause incidental take of juvenile OC coho salmon resulting in sublethal behavior modifications. Effects of actions such as these are largely unquantifiable in the short term. The effects of these activities on population sizes are also largely unquantifiable and unlikely to be measurable in the long term.

Therefore, even though NOAA Fisheries expects some low level of incidental take may occur due to the action covered by this Opinion, the best scientific and commercial data available are not sufficient to enable NOAA Fisheries to estimate a specific amount of incidental take to the species itself. In instances such as this, NOAA Fisheries designates the expected level of take in terms of the extent of take allowed. Therefore, NOAA Fisheries limits the allowable incidental take to take resulting from the action as proposed that affects all reaches of Stream 8 between the Road 20-5-16 culvert and the Siuslaw River for a period of six months following application. Incidental take due to modification of the proposed action or that occurs beyond these areas (*e.g.*, Siuslaw River, Douglas Creek, Stream 1) or time limit is not authorized by this consultation. Moreover, NOAA Fisheries expects the small amount of take that may occur to be non-lethal.

2.2 Reasonable and Prudent Measures

The following reasonable and prudent measures are necessary and appropriate to minimize take of OC coho salmon. Minimizing the amount and extent of take is essential to avoid jeopardy to the listed species.

1. Minimize the likelihood of incidental take associated with insecticide application by implementing conservation measures.

2. Minimize the likelihood of incidental take by confirming that esfenvalerate is not detectable beyond the areas authorized by this incidental take statement.

3. Monitor the effectiveness of the proposed conservation measures in minimizing incidental take and report results to NOAA Fisheries.

2.3 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the BLM must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. To implement reasonable and prudent measure #1 (conservation measueres), the BLM shall:

    a. Implement all conservation measures described in section 1.2 of this Opinion, or gain prior authorization from NOAA Fisheries to forgo implementation of any measure.
    b. Apply no adjuvants other than those identified in the proposed action.
    c. Review the provisions of this Opinion with the contracted applicator prior to commencing insecticide application operations.
    d. Review Tyrrell Orchard's spill response plan with the contracted applicator prior to commencing insecticide application operations.
    e. Notify NOAA Fisheries (R. Markle, 503.230.5419, refer to: 2002/01273) one week prior to commencing the initial insecticide application, when feasible.

f. Allow NOAA Fisheries staff to be present, at its discretion, during any insecticide application operation.
g. Ensure all chemical storage, chemical mixing, and post-application equipment cleaning is completed in such a manner as to prevent the potential contamination of any riparian area, perennial or intermittent waterway, unprotected ephemeral waterway, or wetland.
h. Halt all application operations whenever drift has been observed to exceed 49 feet from the treatment area (either visually observed or indicated by drift card hits at 50 feet).
i. Not recommence insecticide application following a drift-instigated work stoppage until NOAA Fisheries (R. Markle, 503.230.5419) has been notified, and environmental conditions and/or application technique have been sufficiently altered to prevent 50-foot drift.
j. Not conduct insecticide application when measurable precipitation is expected within 4 hours after application.
k. Apply a 200-foot no-spray buffer on all hydrologically connected waterways containing water at the time of application (*i.e.*, not just perennial streams).

2. To implement reasonable and prudent measure #2 (esfenvalerate is not detectable beyond the areas authorized), the BLM shall:

   a. Monitor the boundaries of the designated incidental take areas by implementing those pertinent actions detailed in the Effectiveness Monitoring section of the Water Quality Monitoring Plan (Appendix A).
   b. Complete the *Laboratory Collection, Storage, and Transport Instructions* section of the water quality monitoring plan (Appendix A) adequately to ensure sample validity prior to final BLM authorization to proceed.

3. To implement reasonable and prudent measure #3, (monitoring and reporting), the BLM shall:

   a. Implement the Water Quality Monitoring Plan as presented to NOAA Fisheries during consultation (Appendix A).
   b. Following insecticide application, sample the first over-ground flow of runoff leaving the treatment units.
   c. Continue monitoring runoff for a minimum of 6 months following insecticide application (the period identified by BLM as having the highest probability of aquatic resource contamination due to runoff).
   d. Notify NOAA Fisheries (R. Markle, 503-230-5419) of any significant deviation from the Water Quality Monitoring Plan (Appendix A).
   e. Following the completion of insecticide application and monitoring, provide NOAA Fisheries with a summary report by **December 31, 2003**, describing the relative success of conservation measures required under Reasonable and Prudent Measure #1, and the results of monitoring under Reasonable and Prudent Measures #2 and #3(a). The report should focus on actions taken to ensure that

esfenvalerate was contained within the treatment area to the greatest extent possible. The report should include photo documentation.

f. Submit monitoring reports to:

National Marine Fisheries Service
Attn: Robert Markle
525 NE Oregon Street, #500
Portland, Oregon 97232-2778
Reference: 2002/01273

g. If a dead, sick or injured coho salmon is located, immediately notify Rob Markle, NOAA Fisheries, telephone: 503.230.5419, or NOAA Fisheries Law Enforcement 360.418.4246. Care will be taken in handling sick or injured specimens to ensure effective treatment and care or the handling of dead specimens to preserve biological material in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured species or preservation of biological material from a dead animal, the finder has the responsibility to carry out instruction provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

3. MAGNUSON-STEVENS ACT

3.1 Background

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance essential fish habitat (EFH) for those species regulated under a Federal fisheries management plan. Pursuant to the MSA:

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (§305(b)(2)).
- NOAA Fisheries must provide conservation recommendations for any Federal or state action that would adversely affect EFH (§305(b)(4)(A)).
- Federal agencies must provide a detailed response in writing to NOAA Fisheries within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NOAA Fisheries EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations (§305(b)(4)(B)).

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting this definition of EFH: “Waters” include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include aquatic areas historically used by fish where appropriate; “substrate” includes sediment, hard bottom, structures underlying the waters, and associated biological communities; “necessary” means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 CFR 600.10). Adverse effect means any impact which reduces quality and/or quantity of EFH, and may include direct (*e.g.*, contamination or physical disruption), indirect (*e.g.*, loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

EFH consultation with NOAA Fisheries is required regarding any Federal agency action that may adversely affect EFH, including actions that occur outside EFH, such as certain upstream and upslope activities.

The objectives of this EFH consultation are to determine whether the proposed action would adversely affect designated EFH and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to EFH.

3.2 Identification of Essential Fish Habitat

Pursuant to the MSA the Pacific Fisheries Management Council (PFMC) has designated EFH for three species of Federally-managed Pacific salmon: chinook (*Oncorhynchus tshawytscha*), coho (*O. kisutch*), and Puget Sound pink salmon (*O. gorbuscha*) (PFMC 1999). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC 1999), and longstanding, naturally-impassable barriers (*i.e.*, natural waterfalls in existence for several hundred years). Detailed descriptions and identifications of EFH for salmon are found in Appendix A to Amendment 14 to the *Pacific Coast Salmon Plan* (PFMC 1999). Assessment of potential adverse effects to these species’ EFH from the proposed action is based, in part, on this information.

3.3 Proposed Actions

The proposed action and action area are detailed above in section 1.2 of this Opinion. The action area includes habitats that have been designated as EFH for various life-history stages of coho and chinook salmon.

3.4 Effects of Proposed Action

As described in detail in section 1.5 of this Opinion, the proposed action may result in short- and long-term adverse effects to a variety of habitat features. These adverse effects are:

1. Possible sublethal response (*e.g.*, behavioral changes) by juvenile coho and chinook salmon due to Asana exposure.

2. Possible temporary reductions in abundance of coho and chinook salmon prey species due to compromised mobility as a result of exposure to sublethal concentrations of Asana.

3. Lethal coho and chinook salmon and invertebrate responses are possible, but not expected.

3.5 Conclusion

NOAA Fisheries concludes that the proposed action will adversely affect designated EFH for coho salmon and chinook salmon.

3.6 EFH Conservation Recommendations

Pursuant to section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations to Federal agencies regarding actions which may adversely affect EFH. While NOAA Fisheries understands that the conservation measures described in the biological assessment will be implemented by the BLM, these measures likely are not sufficient to address the adverse impacts to EFH described above. However, the conservation recommendations outlined in section 1.7 and the terms and conditions outlined in section 2.3 are generally applicable to designated EFH for coho and chinook salmon, and address these adverse effects. Consequently, NOAA Fisheries recommends that they be adopted as EFH conservation measures.

3.7 Statutory Response Requirement

Pursuant to the MSA (§305(b)(4)(B)) and 50 CFR 600.920(j), Federal agencies are required to provide a detailed written response to NOAA Fisheries' EFH conservation recommendations within 30 days of receipt of these recommendations. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity on EFH. In the case of a response that is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

3.8 Supplemental Consultation

The BLM must reinitiate EFH consultation with NOAA Fisheries if the proposed action is substantially revised in a manner that may adversely affect EFH, or if new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR 600.920(k)).

4. LITERATURE CITED

BLM (Bureau of Land Management). 2002a. Biological assessment, Travis Tyrrell Seed Orchard insect control. Eugene District, Eugene, Oregon.

BLM (Bureau of Land Management). 2002b. Risk Assessment of Pesticides and Fertilizers Proposed for Use at Tyrrell Seed Orchard. Prepared for the BLM by Labat-Anderson Inc. Eugene District, Eugene, Oregon.

BLM (Bureau of Land Management). 2002c. Horning Seed Orchard esfenvalerate spray 2001 water quality monitoring report. Salem District, Salem, Oregon.

Chapman, R.A., C.M. Tu, C.R. Harris, and C. Cole. 1981. Persistence of Five Pyrethroid Insecticides in Sterile and Natural, Mineral and Organic Soil. Bull. Environm. Contam. Toxicol. 26:513-519.

Coats, J.R., and N.L. O'Donnell-Jeffrey. 1979. Toxicity of four synthetic pyrethroid insecticides to rainbow trout. Bull. Environ. Sci. Health B16:605-615.

Curtis, L.R., W.K. Seim, and G.A. Chapman. 1985. Toxicity of Fenvalerate to Developing Steelhead Trout Following Continuous or Intermittent Exposure. Journal of Toxicology and Environmental Health 15:415-457.

DuPont. 2002. DuPont™ Asana® XL insecticide, technical bulletin. Available at http://www.dupont.com/ag/products/pdfs/H95335.pdf. Accessed on November 21, 2002.

EcoTrust. 2002. A watershed assessment for the Siuslaw Basin. Portland, Oregon. Available at http://www.inforain.org/siuslaw/index.htm. Accessed on April 25, 2002.

Eisler, R. 1992. Fenvalerate hazards to fish, wildlife, and invertebrates: A synoptic review. Contaminant Hazard Reviews Report 24, U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, Maryland 20708. pp 43.

EPA (United States Environmental Protection Agency). 1986. Hazard Evaluation Division, Standard Evaluation Procedure - Ecological Risk Assessment. Prepared by D.J. Urban and N.J. Cook. EPA, Office of Pesticide Programs, Washington, D.C.

Extoxnet (Extension Toxicology Network). 2002. Pesticide information profiles, esfenvalerate. Available at http://ace.orst.edu/info/extoxnet/pips/esfenval.htm. Accessed on November 12, 2002.

Fairchild, J., T. La Point, J. Zajicek, M. Nelson, F. Dwyer, and P. Lovely. 1992. Population-, community- and ecosystem-level responses of aquatic mesocosms to pulsed doses of a pyrethroid insecticide. Environmental Toxicology and Chemistry 11(1):115-129.

Groot, C. And L. Margolis. 1991. Pacific Salmon Life Histories. University of British Columbia, Vancouver, BC, Canada. pp. 564.

Heinis, L.J., and M.L. Knuth. 1992. The mixing, distribution and persistence of esfenvalerate within littoral enclosures. Environmental Toxicology and Chemistry, vol 11, no. 1, pp. 11-25.

Holcombe, G.W., G.L. Phipps, and D.K. Tanner. 1982. The acute toxicity of kethane, dursban, disulfoton, pydrin, and permethrin to fathead minnows *Pimephales promelas* and rainbow trout *Salmo gairdneri*. Environ. Pollut. A29:167-178.

Hollen, B., R. House, J. Johnson, W. Knapp, A. Rhea, and T. Reinwald. 1998. Lower Siuslaw Watershed Analysis. Prepared for Siuslaw National Forest, Mapleton Ranger District. SRI/Shapiro/AGCO, Inc., Portland, Oregon. February. 120 p. plus appendices.

Little, E.E., R.D. Archeski, B.A. Flerov, and V.I. Koslovskaya. 1990. Behavioral indicators of sublethal toxicity in rainbow trout. Archives of Environmental Contamination and Toxicology 19:380-385.

Little, E.E., F.J. Dwyer, J.F. Fairchild, A.J. DeLonay, and J.L. Zajicek. 1993. Survival of bluegill and their behavioral responses during continuous and pulsed exposures to esfenvalerate, a pyrethroid insecticide. Environmental Toxicology and Chemistry, vol. 12, no. 5, pp. 871-878.

Mauck, W.L., L.E. Olson, and L.L. Marking. 1976. Toxicity of natural pyrethrins and five pyrethroids to fish. Archives of Environmental Contamination and Toxicology 4:18-29.

McLeese, D.W., C.D. Metcalfe, and V. Zitko. 1980. Lethality of permethrin, cypermethrin, and fenvalerate to salmon, lobster and shrimp. Bull. Environ. Contam. Toxicol. 4:18-29.

Moore, A.W. and C.P. Waring. 2001. The effects of a synthetic pyrethroid pesticide on some aspects of reproduction in Atlantic salmon (*Salmo salar* L.). Aquatic Toxicology 52:1-12.

Mulla, M.S., H.A. Navvab-Gjrati, and H.A. Darwazeh. 1978. Toxicity of mosquito larvicidal pyrethroids to four species of freshwater fishes. Environ. Entomol. 7:428-430.

Nickelson, T.E., J.W. Nicholas, A.M. McGie, R.B. Lindsay, D.L. Bottom, R.J. Kaiser, and S.E. Jacobs. 1992. Status of anadromous salmonids in Oregon coastal basins. Oregon Department of Fish and Wildlife, Research Development Section and Ocean Salmon Management, 83 p. Oregon Department of Fish and Wildlife, P.O. Box 59, Portland.

ODEQ (Oregon Department of Environmental Quality). 2002. Oregon's Final 1998 Water Quality Limited Streams - 303(d) List, Record ID 2972 and 2973.

<http://www.deq.state.or.us/wq/WQLData/SubBasinList98.asp>. Accessed on April 1, 2002.

ODFW (Oregon Department of Fish and Wildlife). 2001. Annual estimate of wild coho spawner abundance in coastal river basins within the Oregon Coastal ESU, 1990-2000. Found at <http://osu.orst.edu/Dept/ODFW/spawn/coho.htm> under Stratified Random Sampling Estimates for Coastal River Basins 1990-2000. Accessed on December 27, 2001.

ODFW (Oregon Department of Fish and Wildlife). 2002. Preliminary estimated coho spawner abundance 2001 spawning season. Found at <http://osu.orst.edu/Dept/ODFW/spawn/coho.htm> under Estimates of 2001 Spawner abundance in Coastal Rivers Preliminary. Accessed on April 24, 2002.

PFMC (Pacific Fishery Management Council). 1999. Amendment 14 to the Pacific Coast Salmon Plan. Appendix A: Description and Identification of Essential Fish Habitat, Adverse Impacts and Recommended Conservation Measures for Salmon. Portland, Oregon.

Scholz, N.L., N.K. Truelove, B.L. French, B.A. Berejikian, T.P. Quinn, E. Casillas, and T.K. Collier. 2000. Diazinon disrupts antipredator and homing behaviors in chinook salmon (Oncorhynchus tshawytscha). Can. J. Fish. Aquat. Sci. 57: 1911-1918.

Smith, T.M. and G.W. Stratton. 1986. Effects of synthetic pyrethroid insecticides on nontarget organisms. Residue Reviews, vol. 97, pp. 93-120.

Spence, B.C., G.A. Lomnicky, R.M. Hughes, and R.P. Novitzki. 1996. An ecosystem approach to salmonid conservation. TR-4501-96-6057. ManTech Environmental Research Services Corp., Corvallis, Oregon. (Available from the NOAA Fisheries, Portland, Oregon). 356 p.

Tanner, D.K., and M.L. Knuth. 1996. Effects of esfenvalerate on the reproductive success of the bluegill sunfish, *Lepomis macrochirus* in littoral enclosures. Archives of Environmental Contamination and Toxicology, vol. 31, no. 2, pp. 244-251.

Weitkamp, L.A., T.C. Wainwright, G.J. Bryant, G.B. Milner, D.J. Teel, R.G. Kope, and R.S. Waples. 1995. Status review of coho salmon from Washington, Oregon, and California. National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, Washington.

Worthing, C.R., S.B. Walker. 1983. The pesticide manual, 7th edition. Croydon, The British Crop Protection Council. pp. 695.

Appendix A [*includes Appendices B1, B2, B3, and B4 from the BLM BA*]

1. Water Quality Monitoring Plan - Tyrrell Seed Orchard

Goal

The goal of this plan is to determine if implementation of the 2003 Tyrrell Seed Orchard spray plan results in the presence of esfenvalerate in streams due to drift or runoff. This goal includes quantifying the concentrations in both water and sediment to validate impacts predicted by the GLEAMS model and the associated assumptions. The data will be utilized in discussing effects and further long term monitoring in the future EIS.

Background

Agencies and the public are concerned that pesticide application in the Tyrrell Seed Orchard may be harmful to fish, resulting in stream concentrations which exceed those known to have effects on aquatic life. Mitigation measures required by the 2003 Travis Tyrrell Seed Orchard Insect Control EA will minimize the potential affects to water quality from spills, drift, or runoff. The water quality monitoring required by this plan is focused on pesticide drift and surface runoff from the proposed application fields. Pesticide spill and the associated monitoring is outlined in the Pesticide Safety Plan.

This plan covers compliance, effectiveness, and validation monitoring**.** The compliance monitoring is intended to document the design features and mitigation measures which are actually implemented . The effectiveness component documents how well the design features performed in avoiding introduction of esfenvalerate to the aquatic system. The effectiveness data will also be used to validate that the water quality modeling conducted for the EA was conservative.

Specific Objectives

1. Does drift of ground application occur? Monitor all chemical applications to ensure compliance with mitigation measures and to document application rates, environmental conditions and the actual occurrence of drift.

2. Does drift from aerial or ground application of esfenvalerate result in measurable concentrations in the streams associated with the applied fields? Conduct effectiveness monitoring for esfenvalerate to ensure that mitigation measures were effective in preventing drift and runoff from entering surface water.

3. What are the measured esfenvalerate concentrations from runoff water in comparison to those predicted in the impact assessment? Conduct validation monitoring to document the esfenvalerate concentrations in runoff water and sediment and compare to predicted concentrations in relation to literature standards (LC_{50} for trout and embryos).

Compliance Monitoring

All chemical applications will be observed and documented by the Orchard Manager or designated representative. Items to be documented include: (1) type of pesticide applied; (2) date of application; (3) method of application; (4) area treated; (5) amount applied; (6) precipitation for the 3 days preceding and following application; (7) location used for mixing and loading; (8) wind direction and speed; (9) relative humidity; (10) air temperature; and (11) notes regarding whether any leakage or spills occurred. A list of all implemented design features for each unit applied will be included in report form and provided for the Annual Implementation and Monitoring Summary. An existing climate station at the orchard facility will provide a record of compliance documentation and basic information to predict runoff patterns for effectiveness and validation monitoring. See Appendix B-4 for specific compliance monitoring specifications.

Effectiveness Monitoring

Drift Cards.
Spray detection cards would be placed 35, 50 and 100 feet from the edge of the treatment units along riparian buffers. This would include the east boundary of the Swisshome/Mapleton, west boundary of the Noti, and the southwest corner of the Noti along stream 54. They would be spaced 100 to 200 ft. apart. They would be stapled at a 45° angle to wooden lathe, with the cards facing the treatment area. Additionally, a few cards would be strategically placed next to Stream 8 (both sides). Immediately after the application, the cards will be collected and reviewed to determine if any drift has occurred, the extent of the drift, and the potential for contamination of the adjacent waterbodies. A copy of all the cards will be kept on file at the Tyrrell Seed Orchard along with a record of their location and all the compliance monitoring documentation.

Water Samples for Drift Introduction.
Samples will be taken within 24 hours prior to application. Samples will be collected at 15 minutes, 2 hours, 4 hours, 8 hours and 24 hours after the first swath has been sprayed near the buffer strip (as per ODF, 1994). The samples will be collected at a predefined points along flowing streams immediately adjacent to the spray units (Appendix B-1). Blanks, spike, and duplicates will be collected as part of QA/QC measures.

The time of collection will be based on the travel time of water movement in the flowing channels associated with the treatment areas. The calculation for travel time is provided in Appendix B-2.

During the 24 hours after application, a series of composite samples would be collected in Stream 8 and Stream 54 (highest risk) through the use of a continuous pumping sampler. This data will provide a 24 hour concentration to compare with the water quality criteria. If the pumping sampler provides comparable results, the cost of future long term monitoring could be reduced and the efficiency in collecting storm samples improved.

All data will be used in conjunction with the spray cards to illustrate the effectiveness of mitigating potential drift introduction. Samples will be analyzed at a State certified laboratory that has detection limits of ppb for esfenvalerate. Samples will be collected in accordance with laboratory instructions (Appendix B-3). When sites are visited, a water sample will also be collected and analyzed for pH, specific conductance, and turbidity to provide additional interpretive data.

<u>Water and Sediment Sampling for Runoff Introduction</u>.
In terms of the EA GLEAMS modeling results, potential runoff events which occur within the first 6 months after spray application have the highest probability for carrying concentrations which could impact aquatic life. One study (Rashin and Graver,1993) determined that runoff events within the first 72 hours of application were the most important in terms of increases in detectible concentrations in ppb. This monitoring plan will target those periods of precipitation which result in field surface runoff and increased stream flow which are most likely to carry the greatest concentrations. The effectiveness of design features such as increased aeration, wide untreated buffer strips and erosion control will be assessed through monitoring field runoff/field sediment and streamflow concentrations.

Field runoff samples of both water, organic matter, and sediment will be captured at the edge of field in the Swisshome/Mapleton(Swales 52 and 53) and Noti (Grassed Waterway) orchard units (Appendix A: Photo 4 [*page 46 of BA*]). These units will have a collection chamber installed at the low point of the downslope edge of the field. This is intended to provide a collection point for access to surface runoff and sediment from the orchard unit. During rainfall events which exceed 0.5 inches per hour (to be refined on a per unit basis), these sites will be visited and a sub-sampled taken from the collection chamber. A representative sample of the contained sediments will also be taken. Both samples will be shipped to the lab and completed within 7 days. Once the first runoff event is captured and results become available, further sampling will be determined as needed. Since streams are not in close proximity to these units and hydrologic association is questionable, edge of field sampling presents the best opportunity to collect any measurable concentrations lost from the unit. During the stormflow event, streams nearest to these locations will be assessed for connectivity. If connection is apparent, samples will be taken in the associated stream.

Sampling of water and sediment will occur in Stream 8 due to the channel connectivity to the Swisshome/Mapleton and Noti spray units, and the ability to achieve a representative sample from a continuous pumping sampler. This station will collect water and sediment samples on either a flow weighted or time weighted basis with the intention of providing concentrations for multiple runoff events over time. Only samples which are taken during overland flow events will be analyzed at the lab. For more information on the Stream 8 station refer to the validation monitoring section. Comparisons will be made between edge of field concentrations and instream concentrations.

All data will be used in conjunction with on-site climate data to illustrate the effectiveness of design features in minimizing introduction of esfenvalerate to the aquatic system. Samples will be analyzed at a State certified laboratory that has detection limits of ppb for esfenvalerate. Samples will be collected in accordance with laboratory instructions. When sites are visited, a water sample will also be collected and analyzed for pH, specific conductance, and turbidity to provide additional interpretive data.

Validation Monitoring

Validation monitoring is intended to verify the water quality modeling predictions disclosed in the Impact Assessment.

This monitoring component will apply the two basic data sets gathered in the effectiveness monitoring. It is intended to be conducted over the long term and in conjunction with future monitoring and analysis associated with the Tyrrell Integrated Pest Management EIS. The first set is characterizing the runoff and sediment actually leaving the orchard units and the second set is reflecting esfenvalerate concentrations mobilizing on surface water within the orchard unit.

Data Reporting

The data collected will be compiled , analyzed and contained in an Annual IPM Monitoring Report which will be available at the Eugene District and the Travis Tyrrell Seed Orchard. A summary of the results will be presented in the Annual Program Summary for the Eugene District. Results from compliance monitoring will also be included in the Eugene District Annual Implementation Monitoring Report. A copy will be given to NMFS.

References:

Oregon Department of Forestry: Forest Chemical Application Monitoring Program, November 1997

Rashin, E., C. Graber. 1993 Effectiveness of best management practices for aerial application of forest pesticides. TFW - WQ1 - 93-001

[*Appendix B-1*]

Monitoring Sites and Schedule

NOTE: This appendix contains a preliminary monitoring plan. If information emerges that suggests that monitoring at TSO would be more effective if the plan is modified, we will do so. See Appendix A: Photo 4 [*page 46 of BA*] for monitoring locations.

Table B-1a. Water Monitoring Samples Associated with Drift.

Timing	Sample to Be Collected	
	Site 8-2	Site 54-1
Pre-application	X	X
15 minutes*	X	X
2 hour	X	X
4 hour	X	X
8 hour	X	X
24 hour	X	X

* Travel time is included. For example, the 15 minute sample is actually 15 minutes plus the travel time. All of the water samples collected in conjunction with the drift monitoring will be analyzed.

Table B-1b. Water Monitoring Samples Associated with Run-off:

Monitoring Location	Run-Off Sample Collection Device	Stream Flow Monitoring
Site 8-1	X	X
Site 8-2	X	X
Site 54-1		X
Site 54-2 (Grassed Waterway)	X	
Swale 52	X	
Swale 53	X	

GLEAMS modeling indicates that if Esfenvalerate is going to move resulting from runoff, it is most likely to occur during the early runoff events of the season. The first runoff events at TSO general occur during late fall and early winter.

It is anticipated that samples from the Swale sites will be analyzed throughout the runoff season. During rainfall events which exceed .5 inches per hour (to be refined on a per unit basis), these sites will be visited and a sub-sampled taken from the collection chamber. These sites are located in the closest proximity to the application area and are expected to reveal the most information about Esfenvalerate movement.

The sampling units located at Site 8-1 and 8-2 will operate throughout the runoff season. The sampling goal is to analyze samples collected during the first runoff period. If the Swale sampling suggest that Esfenvalerate is still moving after the second runoff period, then the sampling at Sites 8-1 and 8-2 would resume.

[*Appendix B-2*]

Calculation of Travel Time

The travel time is calculated as follows:

$$\frac{L / v}{60 \text{ seconds}} + 15 \text{ minutes} = 15 \text{ minute sample time}$$

L = length of stream between the top of treatment unit and the sample point plus the length of stream between bottom of treatment unit and sample point divided by 2 (ft)

v = average velocity of stream (ft/sec)

Velocity will be measured with a velocity meter when the control sample is collected prior to application to insure that an accurate travel time is being used.

[*Appendix B-3*]

Laboratory Collection, Storage, and Transport Instructions

To Be Added Later
[*As per Term and Condition 2b of the biological opinion, this section must be completed adequately to ensure sample validity prior to BLM issuing final authorization for this action.*]

[*Appendix B-4*]

Compliance Monitoring Items

1. Chemical/Sprayer Compliance

- a. Apply chemical in compliance with the environmental conditions on the label
- b. Prior to application notify downstream users within 0.5 miles
- c. Chemical loading will occur in predesignated areas
- d. Loading zone will be evaluated for spills
- e. Spill kit will be present at loading zones
- f. Assure that equipment used for transport, mixing, and application will not leak pesticide into the water or soil
- g. Proper safety equipment was worn by all employees and contractors

2. Flight Application Compliance (Proposed Action only)

- a. Spray will be released at the lowest height consistent with pest control and flight safety.
- b. Applications more than 10 feet above the canopy should be avoided
- c. Pilot will be briefed on flight and spray requirements prior to application
- d. Areas immediately adjacent to buffers will be treated prior to the rest of the unit
- e. In order to provide maximum spray control, the helicopter will operate around the buffer areas with the boom closest to the sensitive area turned off
- f. Flight paths will not travel over water bodies

3. Ground Based Application Compliance (Alternative A only)

- a. Only trees bearing cones will be treated

4. Buffer Compliance

- a. Buffers were established according to prescription in EA
- b. Spraying will not occur over water bodies(ponds, streams, live water)
- c. All flowing streams will receive a 200 ft. minimum buffer
- d. Application paths will be parallel to buffers where possible so turns are not banked over buffered areas

E. Weather Compliance

- a. Application will not occur if fog is likely to occur.
- b. Application will not occur if rainfall is expected to exceed 0.5 inches per hour a 72 hour period after application
- c. Treatment will occur in the morning with minimal wind

F. Unit Preparation Compliance

- a. Drift cards will be used to monitor drift
- b. Downstream slopes of fields will be aerated prior to application

c. Application will not occur if soils are saturated.
d. Water quality monitoring will occur before, during, and after application
e. If rain has preceded the intended application window, units will be checked for infiltration rate prior to application
f. BLM will clearly mark the application units and boundaries with visible cones ro flagging in a manner that will allow visual identification from the air or ground
g. BLM will deploy a smoke flare in each unit prior to application to provide for pilot/applicator recognition of wind speed and direction.
h. Orchards will be mowed prior to application to minimize the presence of pollinators if deemed necessary.